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A COMPARITIVE STUDY ON HIGHRISE BUILDING WITH SHEARWALL AT DIFFERENT LOCATIONS

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ABSTRACT Shear walls are structural members used to augment the strength of RCC structures. These shear walls will be built in each level of the structure, to form an effective box structure. Equal length shear walls are placed symmetrically on opposite sides of exterior walls of the building. Shear walls are added to the building interior to provide extra strength and stiffness to the building when the exterior walls cannot provide sufficient strength and stiffness. It is necessary to provide these shear walls when the allowable span-width ratio for the floor or roof diaphragm is exceeded.The present work deals with a study on the optimum location of shear walls in symmetrical high rise building. Position of shear walls in symmetrical buildings has due considerations. The high rise building with 12 storeys is analyzed for its axial force using ETABS software. For the analysis of the building for seismic loading with two different Zones (Zone-II & Zone-V) is considered with all soil types.

KEYWORDS : Highrise building,ETABS,Shear Walls.

INTRODUCTION

In building construction, a rigid vertical diaphragm capable of transferring lateral forces from exterior walls, floors, and roofs to the ground foundation in a direction parallel to their planes. Examples are the reinforced-concrete wall or vertical truss. Lateral forces caused by wind, earthquake, and uneven settlement loads, in addition to the weight of structure and occupants; create powerful twisting (torsion) forces. These forces can literally tear (shear) a building apart. Reinforcing a frame by attaching or placing a rigid wall inside it maintains the shape of the frame and prevents rotation at the joints. Shear walls are especially important in high-rise buildings subjected to lateral wind and seismic forces.

In the last two decades, shear walls became an important part of mid and high-rise residential buildings. As part of an earthquake resistant building design, these walls are placed in building plans reducing lateral displacements under earthquake loads. So shear-wall frame structures are obtained.

Shear wall buildings are usually regular in plan and in elevation. However, in some buildings, lower floors are used for commercial purposes and the buildings are characterized with larger plan dimensions at those floors. In other cases, there are setbacks at higher floor levels. Shear wall buildings are commonly used for residential purposes and can house from 100 to 500 inhabitants per building.

NUMERICAL MODELLING

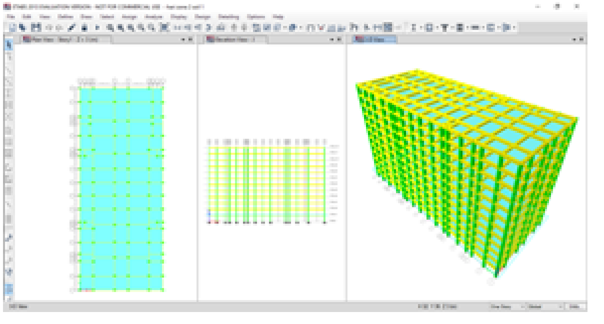
- Height of typical storey = 3.6 m
- Height of ground storey = 3 m
- Length of the building = 40 m
- Width of the building = 30 m
- Height of the building = 40 m
- Number of stores = 12
- Wall thickness = 230 mm
- Slab Thickness = 120 mm
- Grade of the concrete = M30
- Grade of the steel = Fe500
- Thickness of shear wall = 230 mm

Column sizes:

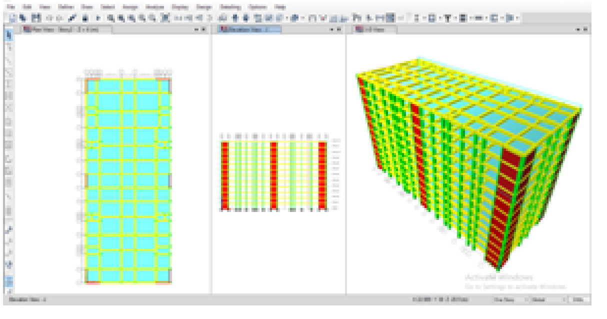
1. Column size (1-8) stories: 700*350 mm
2. Column size (8-12) stories: 700*300 mm

Beam sizes:

1. Beam size (1-8) stories: 550*350 mm
2. Beam size (8-12) stories: 500*300 mm



Without shear zone 2 soil 1



With shear zone 2 soil 1

RESULTS:

CASE 3: Comparison of axial force in static analysis in zone 2, zone 5 in soil 1, soil 2, soil3.

Table 1: Axial force comparison values in zone 2 soil 1 in static analysis

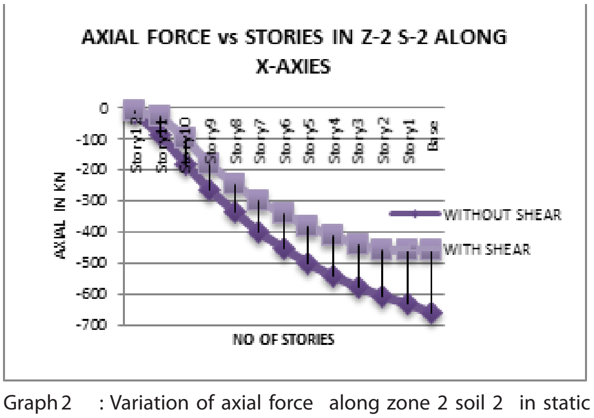
S.NO:	WITHOUT SHEAR	WITH SHEAR
Story12	-13.4886	-7.3764
Story11	-85.3934	-27.4926
Story10	-181.4285	-95.0898
Story9	-269.3518	-174.9398
Story8	-350.6605	-241.6471
Story7	-422.9121	-296.1093
Story6	-485.8467	-344.8373

Story5	-542.5241	-387.1731
Story4	-594.0154	-424.7736
Story3	-640.6996	-457.5838
Story2	-662.8935	-482.8159
Story1	-721.75	-494.5915
Base	-761.3559	-507.286

Graph 1 Variation of axial force along zone 2 soil 1 in static analysis

Table 2 : Axial force comparison values in zone 2 soil 2 in static analysis

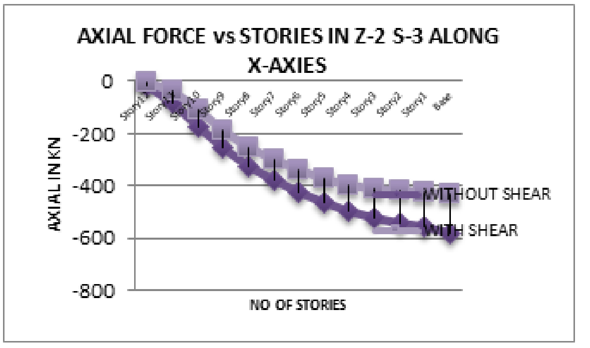
S.NO:	WITHOUT SHEAR	WITH SHEAR
Story12	-13.9553	-7.0664
Story11	-85.1307	-30.0435
Story10	-178.8461	-101.0171
Story9	-262.184	-181.2432
Story8	-336.2673	-246.5453
Story7	-400.4975	-298.374
Story6	-454.2812	-343.2064
Story5	-500.5596	-380.9377
Story4	-540.8328	-413.604
Story3	-575.7757	-440.7711
Story2	-605.9997	-458.737
Story1	-633.1825	-460.2931
Base	-663.3462	-460.6896



Graph 2 : Variation of axial force along zone 2 soil 2 in static analysis

Table 3 : Axial force comparison values in zone 2 soil 3 in static analysis

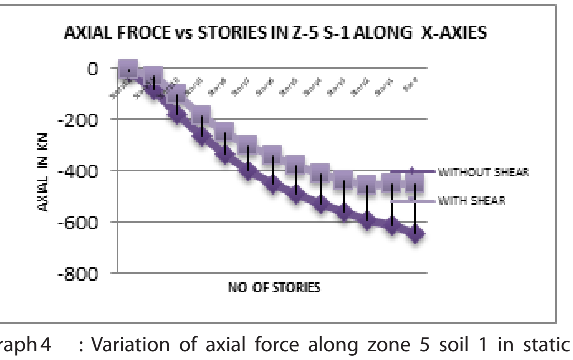
S.NO:	WITHOUT SHEAR	WITH SHEAR
Story12	-14.6894	-6.6187
Story11	-84.9045	-33.7923
Story10	-176.6224	-109.7546
Story9	-256.0118	-190.564
Story8	-324.3898	-253.811
Story7	-381.196	-301.7218
Story6	-427.0097	-340.6362
Story5	-464.4235	-371.0945
Story4	-495.0366	-395.623
Story3	-519.8689	-413.4969
Story2	-539.7855	-420.0055
Story1	-556.9505	-424.83
Base	-578.949	-427.796



Graph 3 : Variation of axial force along zone 2 soil 3 in static analysis

Table 4 : Axial force comparison values in zone 5 soil 1 in static analysis

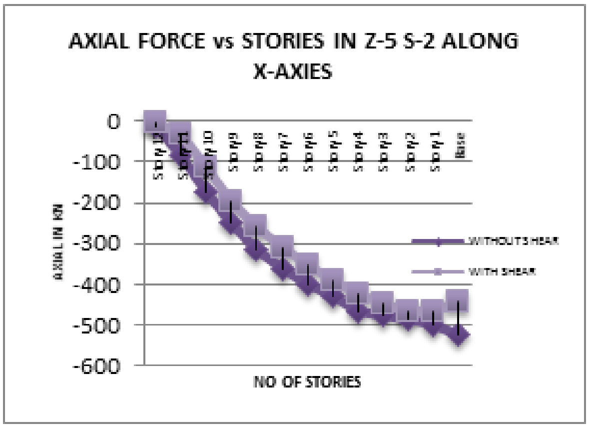
S.NO:	WITHOUT SHEAR	WITH SHEAR
Story12	-14.1447	-6.9975
Story11	-85.0723	-30.6104
Story10	-178.2722	-102.3342
Story9	-260.8912	-182.644
Story8	-333.2021	-247.6338
Story7	-395.5164	-298.8773
Story6	-447.2666	-342.8439
Story5	-491.2341	-379.552
Story4	-529.0144	-411.1219
Story3	-561.3481	-437.035
Story2	-588.9121	-453.3861
Story1	-613.5097	-452.6713
Base	-641.5663	-450.3348



Graph 4 : Variation of axial force along zone 5 soil 1 in static analysis

Table 5 : Axial force comparison values in zone 5 soil 2 in static analysis

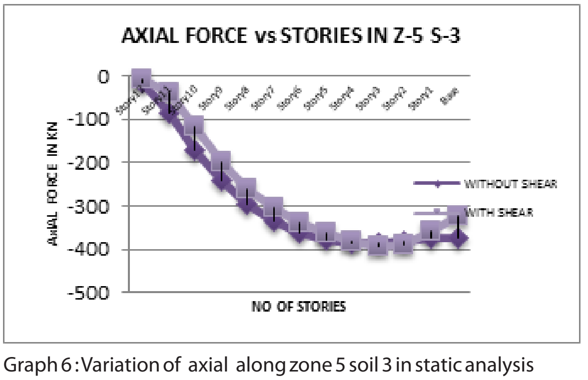
S.NO:	WITHOUT SHEAR	WITH SHEAR
Story12	-15.3723	-5.3796
Story11	-84.694	-33.4373
Story10	-174.5536	-112.4493
Story9	-250.2697	-195.0595
Story8	-313.3399	-259.5258
Story7	-363.2394	-310.0333
Story6	-401.8121	-353.0661
Story5	-430.8053	-389.2144
Story4	-467.8576	-421.6655
Story3	-478.1849	-449.617
Story2	-486.0301	-467.4952
Story1	-500.4324	-464.1225
Base	-522.819	-444.5521



Graph 5 : Variation of axial force along zone 5 soil 2 in static analysis

Table 6 : Axial force comparison values in zone 5 soil 3 in static analysis

S.NO:	WITHOUT SHEAR	WITH SHEAR
Story12	-16.441	-6.1167
Story11	-84.3798	-37.447
Story10	-171.3498	-118.2193
Story9	-241.3433	-199.5372
Story8	-296.138	-260.7609
Story7	-335.2641	-304.9467
Story6	-362.3969	-338.4719
Story5	-378.3863	-362.6411
Story4	-385.9767	-381.1875
Story3	-386.683	-394.977
Story2	-381.8692	-388.656
Story1	-374.7433	-360.518
Base	-375.4105	-325.4563

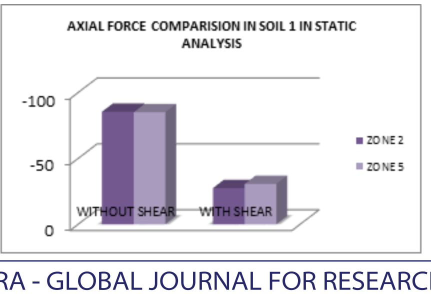


Graph 6 : Variation of axial along zone 5 soil 3 in static analysis

Case 4: Zone wise comparison of Axial force in soil 1, soil 2, soil 3 in static analysis

Table 7 : Variation of axial force along zone 2 and zone 5 in soil 1 in static analysis

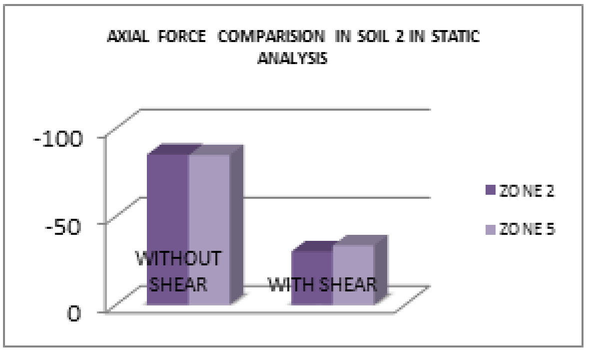
S.NO	WITHOUT SHEAR	WITH SHEAR
ZONE 2	-85.3934	-27.4926
ZONE 5	-85.0723	-30.6104



Graph 7 : Variation of axial force along zone 2 and zone 5 soil 1 in static analysis

Table 8 : Variation of axial force along zone 2 and zone 5 in soil 2 in static analysis

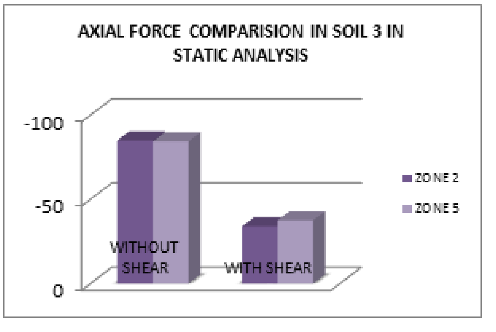
S.NO	WITHOUT SHEAR	WITH SHEAR
ZONE 2	-85.1307	-30.0435
ZONE 5	-84.694	-33.4373



Graph 8 : Variation of axial force along zone 2 and zone 5 soil 2 in static analysis

Table 9 : Variation of axial force along zone 2 and zone 5 in soil 3 in static analysis

S.NO	WITHOUT SHEAR	WITH SHEAR
ZONE 2	-84.9045	-33.7923
ZONE 5	-84.3798	-37.447



Graph 9 : Variation of axial force along zone 2 and zone 5 soil 3 in static analysis

CONCLUSIONS

1- The center of mass and center of rigidity is influenced by adding and positioning of shear wall. It can be concluded that all models are symmetric about x-direction and there is no effect of torsion due to center of mass and center of rigidity in x-direction. The performance of structure with shear wall is better than structure without shear wall because center of mass and center of rigidity become closer.

2- It is evident that shear walls which are provided from foundation to the roof top, are one of the excellent mean for providing earthquake resistance in high rise buildings. These are little expensive but desirable for safe structure.

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